# Exercises: Linear Functions

**1.** Use the point-slope formula to find an equation for the line through the point $(2,1)$ with slope $1/3$.

**2.** Use the point-slope formula to find an equation for the line through the points $(1,2)$ and $(5,8)$

**3.** Let $f$ be a linear function, and suppose that $f(2)=5$ and $f$ has slope $-1/2$. Find a formula for $f(x)$.

**4.** Let $f$ be a linear function, and suppose that $f(2)=5$ and $f(4)=8$. Find a formula for $f(x)$.

**5–8** ■ Determine whether the given data is consistent with a linear function. If so, find an approximate linear formula for $f(x)$.

**5.** $f(3)=4$, $f(4)=7$, and $f(5)=10$.

**6.** $f(1.2)=3.61$, $f(1.4)=3.65$, and $f(1.6)=3.69$.

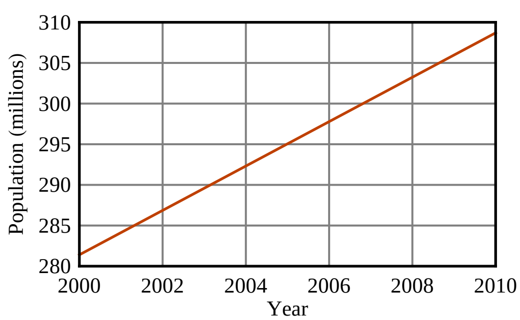
**7.** $f(10)=4$, $f(15)=6$, and $f(20)=9$.

**8.** $f(0)=40$, $f(3)=25$, and $f(6)=10$.

**9.** Let $f$ be a function, and suppose that $f(2)=4$ and $f(3)=5.5$. Use a linear approximation to estimate $f(5)$.

**10.** Let $f$ be a function, and suppose that $f(1)=3$ and $f(2)=5$. Use a linear approximation to estimate $f(1.3)$.

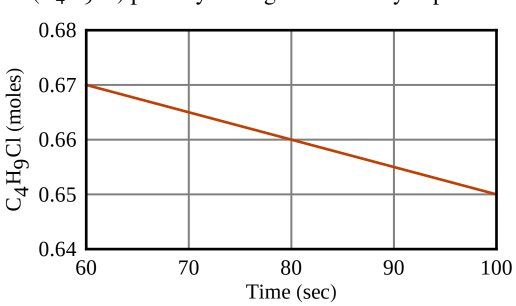
**11.** The following graph shows the increase in the total population of the United States over the last decade:




(a) Estimate the rate at which the population was increasing.

(b) Use a linear approximation to estimate the population in the year 2025.

**12.** The following graph shows the decrease in the amount of butyl chloride ($C_4H_9Cl$) partway through a chemistry experiment:




(a) How quickly is the amount of butyl chloride decreasing?

(b) Find an approximate linear formula for the amount of butyl chloride after $t$ seconds.

**13.** An environmental scientist is measuring the effect of a recent oil spill on a nearby lake. Three days after the spill, the concentration of hydrocarbons in the lake is approximately 5000 ppm. Five days after the spill, the concentration has increased to approximately 7600 ppm.

(a) How quickly is the concentration of hydrocarbons in the lake increasing?

(b) Find an approximate linear formula for the concentration of hydrocarbons in the lake after $t$ days.

**14.** A meteorologist is using a weather balloon to measure the air temperature at high altitudes. At the time of the measure- ment, the air temperature at sea level was approximately 21 °C, and the air temperature at an altitude of 4.0 km was approximately −5 °C.

(a) How quickly is the air temperature decreasing with altitude?

(b) Find an approximate linear formula for the air temperature at an altitude of $h$ kilometers.

**15.** Let $f$ be a function, and suppose that $f(1)=5$ and $f(2)=8$. Use a linear approximation to estimate the value of $x$ for which $f(x)=20$.

**16.** Let $f$ be a function, and suppose that $f(3)=-1$ and $f(4)=4$. Use a linear approximation to estimate the value of $x$ for which $f(x)=0$.

**17.** On a hot summer day, the water in a backyard swimming pool has a temperature of 70 °F at 8:00 am. By 9:30 am, the temperature has increased to 73 °F.

(a) At what rate is the temperature of the water increasing?

(b) Use a linear approximation to estimate the temperature of the pool at 11:00 am.

(c) At this rate, when will the temperature reach 80 °F?

**18.** A new laptop battery has a maximum charge of 5000 mA · h. After three months of use, the maximum charge of the battery has decreased to 4625 mA · h.

(a) How quickly is the maximum charge of the battery decreasing?

(b) At this rate, what will the maximum charge of the battery be after five months?

(c) The manufacturer recommends replacing the battery once the maximum charge decreases to 2500 mA · h. When will this occur?

# Answers

1. $y = 1 + \frac{1}{3}(x - 2)$
2. $y = 2 + \frac{3}{2}(x - 1)$
3. $f(x) = 5 - \frac{1}{2}(x - 2)$
4. $f(x) = 5 + \frac{3}{2}(x - 2)$
5. $f(x) \approx 3x - 5$
6. $f(x) \approx 0.2x + 3.37$
7. not linear
8. $f(x) \approx 40 - 5x$
9. 8.5
10. 3.6
11. (a) 2.6 million/year (b) 347 million
12. (a) 0.0005 moles/sec (b) $0.7 - 0.0005t$ moles
13. (a) 1300 ppm/day (b) $1300t + 1100$ ppm
14. (a) 6.5 °C/km (b) $21 - 6.5h$ °C
15. 6
16. 3.2
17. (a) 2 °F/hour (b) 76 °F (c) 1:00 pm
18. (a) 125 mA · h/month (b) 4375 mA · h (c) 20 months